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OPERATING EXPERIENCE WEEKLY SUMMARY

Office of Nuclear and Facility Safety

January 30 through February 5, 1998

Summary 98-05

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EVENTS

1. PICRIC ACID FOUND IN CRAWL SPACE AT HANFORD

On January 28, 1998, at the Hanford 327 Facility, a maintenance crew discovered a small vial labeled “picric acid” in a crawl space while they were performing a pre-job walk-down for maintenance on some steam lines. Picric acid is normally used as an aqueous solution and an explosive mixture results when the solution crystallizes. The facility manager evacuated the facility, and the Hanford deputy manager declared an alert level emergency. An “alert” is the lowest level of emergency classification. After investigators determined worst-case potential consequences, the basis for declaring the alert was no longer valid and the deputy manager cancelled the alert. Facility personnel reported that no one was injured, no damage occurred to the facility or equipment, and there was no release of materials to the environment. (ORPS Report RL--PHMC-327FAC-1998-0002)

Facility emergency response personnel developed a written plan and performed a dry run to put the material in a safe status. Following the dry run, two hazardous material specialists from the Hanford fire department, dressed in “bunker gear” and fire-rated, self-contained breathing apparatus, entered the crawl space and transferred the vial to a bucket containing water.

During the investigation, the maintenance crew leader recalled that the clear plastic vial was approximately 3 inches long and 1 inch in diameter, with a white plastic lid. He stated that the vial was approximately two-thirds full of a white granular substance. The label identified the contents as picric acid, and indicated the date as 1988. Investigators have not determined how the vial of material got into the crawl space. Investigators are determining lessons learned for this event and are evaluating the site emergency response actions to determine if improvements are required.

NFS reported a similar occurrence in Weekly Summary 96-39. A laboratory technician at the Savannah River Site found a bottle containing approximately 8 ounces of picric acid with some crystallized particles. Hazardous materials specialists responded and took the acid to a safe site location to detonate it. (ORPS Report SR--WSRC-LTA-1996-0033)

OEAF engineers reviewed the ORPS database for similar occurrences involving picric acid and found eight other events dating back to 1990. In these events, explosive safety specialists removed the acid and either chemically neutralized it or detonated it in a safe area. Investigators determined that for most of the events the picric acid was from previous operations and a legacy chemical.

These events highlight the need for managers to develop appropriate programs and procedures to enable personnel to handle chemicals safely. These programs should address safe handling, storage, disposal, and transportation requirements for chemicals. Facility managers should also ensure that workers are familiar with facility safety precautions and emergency procedures. Hazardous chemicals must be identified and their risks understood. Risks should be evaluated, and barriers should be put in place to reduce them. Facility managers should emphasize the importance of researching all available sources of chemical safety information. Picric acid in its crystalline form is a Class A explosive (OSHA 1910.109). Chemical data on picric acid may be found in the National Institute for Occupational Safety and Health *Pocket Guide to Chemical Hazards*.

Initiation of even small amounts of explosives can result in personnel injury. Larger explosions could affect other hazardous materials in the immediate area, resulting in a more serious accident. DOE M 440.1, *DOE Explosives Safety Manual,* prescribes safety procedures for handling explosives and provides guidance and requirements for storage. Hazardous materials training should include labeling systems and material data sheet terms, proper use of engineering controls and protective equipment, and preparation for unexpected hazardous conditions.

OSHA regulation 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*, states that hazard barriers and controls must be designed, implemented, and validated before initiating chemical processes. The regulation also states that these barriers and controls should be reviewed periodically and updated as necessary.

Information about chemicals, chemical hazards, and chemical safety programs can be found on the DOE Office of Environment, Safety and Health, Office of Worker Safety, Chemical Safety Program Home Page. The home page (located at URL http://tis-hq.eh.doe.gov/web/chem_safety/) provides links to many sources of information, including requirements and guidelines, lessons learned, chemical safety networking, and chemical safety tools.

KEYWORDS: acid, chemical, explosives

FUNCTIONAL AREA: Chemical Safety, Explosive Safety

2. SURVEILLANCES AND INSPECTIONS NOT PERFORMED BECAUSE OF COMPUTERIZED SCHEDULING PROBLEMS

This week OEAF engineers reviewed two events involving the failure to conduct surveillances and inspections because of problems associated with computerized scheduling programs. On January 29, 1998, facility personnel at the Hanford Tank Farm discovered that functional tests for the high-efficiency particulate air filter differential pressure interlocks and the stack high radiation alarm were not current. Investigators determined that no one entered facility safety documentation changes into the computerized planned maintenance system used to schedule surveillances. On January 5, 1998, at the East Tennessee Technology Park (K-25 Site), fire protection personnel reviewing inspection and test records discovered that the database contained no inspection records for five building sections. Investigators determined that, because of a programming error, the computerized fire inspections management information system did not schedule several monthly fire department walk-downs, monthly sprinkler system inspections, semiannual alarm tests, main drain tests, and annual fire extinguisher inspections. These issues are significant because failure to perform surveillances and inspections at required frequencies on equipment required to be operable as part of the facility safety basis could violate the operational safety and technical safety requirements that represent the minimum acceptable controls necessary to ensure safe operation. (ORPS Reports RL--PHMC-TANKFARM-1998-0010 and ORO--LMES-K25GENLAN-1998-0003)

At the tank farm, facility operators implemented the immediate actions required by the limiting conditions for operation until the surveillance requirements were satisfied. Investigators determined that both the high-efficiency particulate air filter differential pressure interlocks and the stack high radiation alarm system are required to be tested every 92 days. Facility personnel last checked the differential pressure interlocks on January 22, 1996, and the stack high radiation alarm system on August 26, 1997. Investigators determined the surveillances were missed because facility personnel did not enter recent changes to the facility safety documentation (basis for interim operation) into the computerized planned maintenance system. They also determined that no procedures were in place to ensure that these changes would be incorporated into the system.

At the East Tennessee Technology Park, a computer programmer discovered that an error in the programming logic for the fire inspections management information system had eliminated inspections of five building sections from the scheduler when data-entry personnel placed five other buildings in standby status and removed them from the work schedule. Programmers corrected the error and tested the software to ensure that similar scheduling errors will not occur. Fire protection personnel completed all sprinkler system inspections on January 9. They completed all annual fire extinguisher inspections, semiannual alarm tests, and main drain tests on January 16.

NFS reported another computerized scheduling problem in Weekly Summary 94-01 where an employee at the Savannah River Vitrification Facility inadvertently entered the wrong data into a computer database used to track and schedule tests for Class B lower explosive limit monitors. The error resulted in exceeding the allowable period between calibrations because the database calculated the next calibration due date based on the functional test date rather the last calibration date. The employee incorrectly entered the functional test date into the data field for the calibration test. (ORPS Report SR--WSRC-WVIT-1994-0002)

NFS has reported numerous events where inspections were not performed at the required frequencies. Following are some examples.

- Weekly Summaries 97-17 and 97-15 reported missed surveillances at the Oak Ridge Radiochemistry Engineering Development Center. In one event, inspectors failed to perform an efficiency test on high-efficiency particulate air filters for 18 months because a hold tag had not been removed after mechanics replaced the filters. In the other event, Fire Department personnel did not perform monthly inspections because of an informal policy for establishing inspection frequencies. (ORPS Reports ORO--ORNL-X10REDC-1997-0003 and 0002)

- Weekly Summary 94-13 reported that operators at the Idaho Irradiated Fissile Material Storage facility discovered that atmospheric samples of certain dry wells were not performed every 2 years, as required by the technical standard. Investigators determined that surveillance scheduling was not automated, and when the individual responsible for tracking the performance of the surveillance was transferred to another group, the remaining personnel forgot to perform the surveillance. As a corrective action, management personnel developed a site-wide computerized surveillance scheduling program. (ORPS Report ID--WINC-FUELRCSTR-1994-0007)

Proper performance of surveillances is important to guarantee correct functioning of operational safety required systems. These events illustrate the importance of properly tracking, scheduling, and conducting surveillance tests and inspections. Computer programs and databases that track operational safety and technical safety requirements and schedule surveillances, inspections, and calibrations are effective tools. However, these computer systems can be affected by programming errors, data-entry errors, and failure to input or update facility requirements. It is important to implement adequate administrative controls over computer software programs that could affect safety-related systems and components. Software programs should be independently verified and validated in accordance with approved procedures, and the results should be well documented. Modifications to software and newly purchased software should be subjected to verification and validation if safety-related functions are involved. The Office of Environment, Safety and Health has addressed computer software quality issues in ES&H Bulletin DOE/EH-0121, Issue 89-9, "Technical Software Quality Assurance Issues," issued in December 1989. Computer organizations may also wish to review IEEE Standard 828-1990, *IEEE Standard for Software Configuration Management Plans*, and IEEE Standard 7.4.3.2-1993, *American National Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations.*

DOE contractors who operate nuclear facilities and fail to conduct required surveillances or implement corrective actions for identified deficiencies could be subjected to Price-Anderson civil penalties under the work processes and quality improvement provisions of 10 CFR 830.120, *Quality Assurance Requirements*. DOE facility managers should review their surveillance test procedures to ensure that scheduled frequencies are correct as specified in their safety documentation. DOE O 5480.22, *Technical Safety Requirements*, attachment 1, describes the purpose of surveillance requirements and states that each surveillance shall be performed within the specified interval. General principle 1 states: "A system is considered operable as long as there exists assurance that it is capable of performing its specified safety function(s)." Surveillance testing is essential in providing this assurance.

KEYWORDS: surveillance, test, inspection, compliance, computer, software

FUNCTIONAL AREAS: Surveillance, Licensing/Compliance

3. SAFETY VIOLATIONS AT LAWRENCE BERKELEY NATIONAL LABORATORY

On January 28, 1998, at Lawrence Berkeley National Laboratory, a construction safety coordinator performing a daily safety compliance inspection observed subcontract workers violating safety procedures while removing ductwork. One worker was standing on a crane walk-way without the crane being locked out or tagged out in violation of facility procedures. Another subcontract worker was working on a maintenance platform that was approximately 25 feet high. He was not using fall protection equipment, which violated facility procedures and OSHA requirements. The construction safety coordinator stopped work and notified the subcontractor site superintendent of the procedural violations. Failure to follow safety procedures resulted in elevated work suspension and could have resulted in an injury or fatality. (ORPS Report SAN--LBL-OPERATIONS-1998-0002)

Investigators determined that one worker was walking across the crane walk-way to access the maintenance platform where the other worker was located. They also determined that other workers had removed the floor plates from the maintenance platform and did not install guardrails. Investigators determined that facility procedures require blocking any potentially dangerous motion during work activities and require fall protection equipment for elevated work.

The facility manager held a critique. Critique members determined that the root cause of this event was inadequate job planning. They learned that the subcontractor work planners did not include requirements for locking out the crane or for using fall protection in the work package because they intended that the workers would use a scissors-lift to access the ductwork. However, the scissors-lift did not extend high enough for the workers to access the area, so they used the maintenance platform. Critique members determined that the planners should have considered accessibility when they planned the job. They also determined that the workers violated safety procedures and the work plan when they used the maintenance platform. Critique members determined that the workers had received training on the facility's safety requirements. The facility manager suspended all elevated work in the facility until the subcontractor implements satisfactory corrective actions. The facility manager will develop additional corrective actions as necessary.

A similar event occurred at Lawrence Berkeley National Laboratory in 1996. On July 2, 1996, a subcontract worker was hospitalized with fractures to his wrist, leg, and spinal vertebra after he fell approximately 16 feet through a metal deck opening. A special joint investigation committee of Lawrence Berkeley and DOE personnel conducted a Type B accident investigation of this event. They also developed a corrective action plan to strengthen safety programs. Corrective actions included performing daily safety compliance inspections. (ORPS Report SAN--LBL-OPERATIONS-1996-0003 and *Type B Accident Investigation Board Report on the July 2, 1996, Fall with Serious Injuries*)

OEAF engineers also reviewed a recent event at the Rocky Flats Plutonium Processing and Handling Facility. On January 28, 1998, an electrical worker was injured when he fell while pulling wire through a conduit in a ceiling. The worker was standing on an 8-foot metal electrical cabinet that he was using as a work platform when he fell. Investigators determined that his work package required the use of harnesses. The harnesses were located in the room where work was being performed, but the worker failed to use them. (ORPS Report RFO--KHLL-371OPS-1998-0007)

NFS has reported numerous fall protection violations and fall-related injuries in the Weekly Summary. Following are some examples.

- Weekly Summary 97-44 reported that a subcontractor pipefitter at the Oak Ridge National Laboratory fell through a roof opening of a tank vault building and landed on wooden scaffold decking 15 feet below. As the pipefitter walked on a temporary plywood cover for a hatch into the tank vault, it dislodged, allowing the pipefitter to fall. (ORPS Report ORO--LMES-X10CM-1997-0005)

- Weekly Summary 97-42 reported that a safety inspector at the Los Alamos National Laboratory initiated a stop work order to a roofing subcontractor because of repeated fall protection violations. The safety inspector observed a subcontractor safety monitor assisting in roofing activities. OSHA regulations and contractor procedures required using a dedicated safety monitor who had no other responsibilities. (ORPS Report ALO-LA-LANL-LANL-1997-0002)

- Weekly Summaries 96-27 and 96-08 reported a fatal fall at the Idaho National Engineering Laboratory. A subcontractor project engineer, who was not wearing fall protection, fell 17 feet from a temporary platform. The engineer suffered severe head and neck injuries and died. The temporary platform had no guardrails, toeboards, or other fall protection. The Office of Environment, Safety and Health issued a Type A Accident Investigation Board Report stating that hazards were not identified and there were no barriers in place to prevent the accident. (INEL Lessons Learned #96116, OEWS 96-08, *Type A Accident Investigation Board Report on the February 20, 1996, Fall Fatality at the Radioactive Waste Management Complex Transuranic Storage Area - Retrieval Enclosure*, ORPS Report ID--LITC-RWMC-1996-0001)

OEAF engineers searched the ORPS database for reports involving the lack of fall protection and found 86 occurrences. We established rates and the trend of occurrences by normalizing the number of occurrences to the number of hours worked. We determined that reporting of fall protection issues was relatively constant until the first quarter of 1996, when a fall fatality occurred at Idaho National Laboratory. We believe that after the Idaho event, DOE facilities became more aware of the safety issues involved and were finding and reporting more occurrences. However, this trend has declined since 1996, and occurrences are currently being submitted at approximately the same rate as before the Idaho event. Figure 3-1 shows the distribution of occurrences by quarter versus the number of occurrences per 200,000 hours worked.

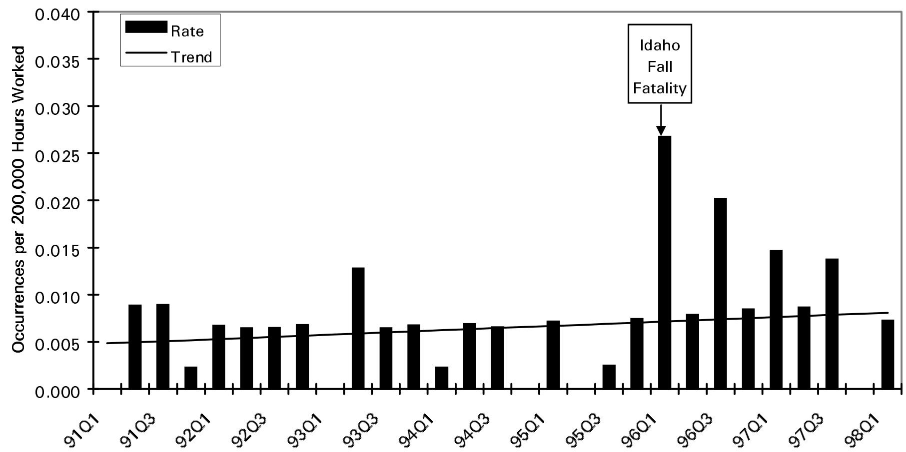

Figure 3-1. Lack of Fall Protection Events[1]

The Office of Environment, Safety and Health addressed fall protection in Safety & Health Note, DOE/EH-0489, Issue 95-3, "New OSHA Booklet on Fall Protection in Construction." This booklet provides a generic overview of fall protection. The booklet states: "In the construction industry in the U.S., falls are the leading cause of worker fatalities. Each year, on average, between 150 and 200 workers are killed and more than 100,000 are injured as a result of falls at construction sites. OSHA recognizes that accidents involving falls are generally complex events frequently involving a variety of factors. Consequently the standard for fall protection deals with both the human and equipment-related issues in protecting workers from fall hazards." The booklet provides guidance for employers and employees to follow when protection is required and discusses how to select fall protection systems.

DOE facility managers should review requirements and procedures to ensure that employees are familiar with both site and OSHA requirements regarding fall protection when performing elevated work. OSHA requires that employees engaged in elevated work activities be protected from falling by (1) guardrail systems, (2) safety net systems, (3) personal fall arrest systems, and (4) a combination of a warning line system and guardrail system or a warning line system and a safety monitoring system. Employees performing elevated work on platforms of 50 feet or less in width are required to use a safety monitoring system (i.e., without the warning line system).

- DOE O 4330.4B, *Maintenance Management Program*, chapter II, section 8.3.6, "Control of Non-Facility Contractor and Subcontractor Personnel," states that non-facility contractor and subcontractor managers should be held accountable for the

[1] OEAF engineers searched the ORPS database using the graphical user interface for reports that contained all narrative of <order><sentence> ("no", "fall", "protection") or <order><sentence> ("without", "fall", "protection") and found 86 events.

work performed by their personnel. Section 8.3.3 requires maintenance supervisors to routinely monitor maintenance activities to ensure they are in accordance with DOE and facility policies and procedures and includes monitoring of industrial safety practices.

- OSHA regulation 29 CFR 1926.501, "*Duty To Have Fall Protection*," requires employers, except for those involved in "steel erection," to determine that walking/working surfaces have the strength and structural integrity to safely support them. The regulation further states that each employee on a walking/working surface with an unprotected side or edge that is 6 feet or more above a lower level must be protected from falling by guardrail systems, safety net systems, or personal fall arrest systems.

- OSHA regulation 29 CFR 1926.502, "*Fall Protection Systems Criteria and Practices*," requires employers to provide and install fall protection systems for employees and to comply with all other pertinent requirements before employees begin work that necessitates the fall protection. Effective January 1, 1998, OSHA no longer includes body belts as an acceptable personal fall arrest system.

A copy of the Safety & Health Note can be obtained by accessing URL http://tis.eh.doe.gov:80/docs/bull/links.html or can be obtained by calling (301) 916-4444. To obtain a copy of the OSHA booklet, contact the local regional or area OSHA office (listed in the telephone directory under U.S. Department of Labor) or write to OSHA Publications Office, 200 Constitution Ave., NW, Room N-3101, Washington, DC 20210. OSHA regulations can also be found at URL http://www.osha-slc.gov/.

KEYWORDS: construction, fall protection, injury

FUNCTIONAL AREAS: Construction, Industrial Safety

4. UNAUTHORIZED OPERATION OF LASERS

On February 2, 1998, at Lawrence Livermore National Laboratory, a technician performing routine laser interlock inspections discovered a "participating guest" from the Naval Research Laboratory operating an open beam, Class II laser without authorization. The technician stopped the operation, secured the area, and notified the appropriate facility managers. Investigators determined that the guest operated the laser with the interlocks bypassed and without an approved project work plan. He also operated a Class IIIB, cadmium/helium laser with the interlocks bypassed and without an approved project work plan. Lasers pose a hazard to the retina, cornea, and lens of the eye. Failure to follow procedures and bypassing interlocks can result in personal injury or damage to equipment. (ORPS Report SAN--LLNL-LLNL-1998-0007)

Investigators determined that the Laboratory health and safety manual does not permit the interlocks to be bypassed. They also determined that facility safety procedures require an approved project work plan for operation of either of these lasers. The associate director for chemistry directed an incident analysis committee to perform an investigation of this event. The committee is continuing their investigation to determine causes and recommended corrective actions. OEAF engineers will follow this event and provide information when the committee's report is available.

NFS reported laser safety violations in Weekly Summaries 97-47 and 96-48.

- Weekly Summary 97-47 reported that experimenters at the Ames Laboratory left a Class IIIB laser operating unattended in violation of laboratory laser safety requirements. Investigators determined that the operator had not taken the mandatory laser and high-voltage safety training. They also determined that the operator should have performed the operation with the door closed, but he propped open the door for convenience. (ORPS Report CH--AMES-AMES-1997-0003)

- Weekly Summary 96-48 reported that a security technician at Lawrence Livermore Site was hit in the eyes by the reflected beam from an operating Class IIIB laser when he entered a room to work on an interlock status panel. Investigators determined that a lead experimenter had left the laser on overnight in violation of laboratory laser safety requirements. An ophthalmologist determined that there was no injury to the experimenter's eye. (ORPS Report SAN--LLNL-LLNL-1996-0060)

OEAF engineers reviewed the ORPS database for other occurrences involving laser safety violations and found one occurrence report describing an event at Sandia National Laboratory–Livermore. In this event, a Sandia employee was attempting to align an unfocused beam from a Class IIIB laser when a stray beam from an optic polarizer he was holding glanced onto his face. An ophthalmologist determined that there was no injury to the employee's eye. (ORPS Report ALO-KO-SNL-CASITE-1997-0001)

Managers of facilities using lasers should ensure that experimenters understand hazard controls unique to laser operations. Training should include information from ANSI Z136.1-1993, *American National Standard for the Safe Use of Lasers*. This standard provides guidance for the safe use of lasers and laser systems by defining hazard control measures for each of the four laser classifications. Control measures include (1) engineering controls, such as beam housings, beam shutters, and attenuators; (2) administrative controls, such as procedures, warning signs, labels, and training; and (3) personal protective equipment, such as eyewear, gloves, and special clothing. This standard is endorsed in part by DOE O 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*, paragraph 12, "Contractor Requirements Document."

ANSI Z136.1-1993 laser hazard classifications are used to signify the level of hazard inherent in a laser system and the extent of safety controls required. Lasers are grouped into four classes, from Class I (the least hazardous) to Class IV, which is the most hazardous. Complete definitions for each class are contained in ANSI Z136.1-1993.

The *Hazard and Barrier Analysis Guide*, developed by OEAF, discusses barriers that provide controls over hazards associated with a job. The guide provides a detailed analysis for selecting optimum barriers, including a matrix that displays the effectiveness of different barriers in protecting against some common hazards. A copy of the *Hazards and Barrier Analysis Guide* is available from Jim Snell, (301) 903-4094. A copy may also be obtained by contacting the ES&H Information Center, (800) 473-4375, or by writing to U.S. Department of Energy, ES&H Information Center, EH-72, 19901 Germantown Road, Germantown, MD 20874.

KEYWORDS: industrial safety, laser, training and qualifications

FUNCTIONAL AREAS: Research and Development, Industrial Safety, Training and Qualification

5. AMERICIUM SOURCE EXPLODES WHEN HEATED WITH A TORCH

On January 22, 1998, at a gage manufacturing company in California, a sealed, 100 mCi, americium-241 source capsule exploded and released its contents when a radiation safety officer attempted to melt the epoxy securing the capsule in its tungsten holder. The radiation safety officer used a small, hand-held butane torch to heat the epoxy in order to remove the capsule (protective envelope) from the holder. He performed this procedure inside a fume hood in a source-loading room. While the epoxy was being heated, the capsule exploded and the source material scattered inside the hood. The radiation safety officer detected contamination on his clothing, on the floor, and on tables in the room. This event is significant because the radiation safety officer subjected the source capsule to conditions beyond those for which it was designed, resulting in dispersal of radioactive material. (NRC Event Number 33603)

The company planned to return several sources to the source manufacturer for wear evaluation and possible recycling. Company representatives said that the manufacturer would not accept the sources if they were returned in the tungsten holder. The radiation safety officer decided to remove the sources from the holders by burning away the epoxy and pushing the capsules out of the holders a sufficient distance to allow them to be removed. On a previous day, he successfully removed two source capsules from their holders using this procedure.

On January 23, representatives of the company notified the NRC Radiological Branch and the State Radiological Health Branch of the incident. Investigators immediately visited the site and conducted an evaluation. They ordered immediate urine and fecal bioassays. Bioassay results are not known at this time. Investigators determined that the door for the fume hood was almost fully closed, which protected the radiation safety officer from direct contamination to his face. In addition to the clothing and room contamination, 400 to 13,500 dpm fixed and 21,000 dpm removable alpha contamination was detected at the exhaust duct for the hood on the facility roof. The entire fume hood and its ductwork will be disassembled and packaged for disposal. Investigators have not determined whether the radiation safety officer performed a safety evaluation of this procedure or if he contacted the source manufacturer for recommendation or guidance. Representatives from the State Radiological Health Branch are continuing their investigation and are considering enforcement action against the company.

In Weekly Summary 96-13, NFS reported that an employee of the same company was internally contaminated from americium-241 oxide powder while checking a sealed 10-mCi source for leaks. The employee inhaled the oxide powder from the 1960-vintage source when a welded seal plug fractured. Bioassay results indicated an internal exposure of between 34 and 85 rem committed effective dose equivalent. (NRC Event Number 30137)

These events underscore the importance of exercising care when working with radioactive sources. The release of source material from leaking or mishandled sources can lead to the spread of contamination and personnel exposure. Exercising sound radiological practices and common sense is important when working with sources. Procedures or processes should be evaluated for potential safety hazards, including the risk of jeopardizing the integrity of the source capsule. In this event, heating the capsule could have caused the capsule to burst at a temperature lower than its rated classification because the internal pressure could have increased over time from the buildup of helium from radioactive decay. Sources are coded to indicate their classification based on manufacturer's testing as identified in ANSI N43.6, *Sealed Radioactive Sources, Classification* (formerly ANSI N542-1977). The standard provides source manufacturers with a set of tests to evaluate sources under specified conditions and to assist users in selecting the appropriate sources for their applications. Tests are prescribed for temperature, external pressure, impact, vibration, and puncture over a range of severity. The standard identifies sealed-source performance requirements for a variety of source applications in terms of a specific degree of severity of each test. Appendixes provide leak-test methods and guidance for quality assurance and control.

Information on control and accountability of sealed sources can be found in DOE/EH-256T, *Radiological Control Manual*, article 431, "Radioactive Source Controls." The majority of pertinent radiological protection requirements have become codified through promulgation of 10 CFR 835, *Occupation al Radiation Protection*. However, 10 CFR 835 currently does not address sealed radioactive source accountability; source accountability will be addressed in a pending revision. Facility managers should refer to DOE N 441.1, *Radiological Protection for DOE Activities*, for information on the control and accountability of sealed radioactive sources. The administrative life span of DOE N 441.1 was from September 30, 1995, to September 30, 1996, but this was extended for 1 year by DOE N 441.2, and will be extended an additional year by DOE N 441.3.

KEYWORDS: americium, contamination, radiation protection, sealed source

FUNCTIONAL AREAS: Radiation Protection

6. NYLON SLING FAILS DURING HOISTING AND RIGGING OPERATIONS

On January 24, 1998, at the Fernald Environmental Management Project, a nylon sling failed when subcontractor riggers used a front-end loader to lift a 10-foot diameter, 16-foot long, corrugated steel pipe. The pipe did not fall because it was suspended by a second sling. Investigators reported that riggers had cut two holes 180 degrees apart at one end of the pipe so they could attach shackles to the pipe. Investigators believe that the sharp edge of the corrugated pipe cut the sling as riggers lifted the pipe from a horizontal position to a vertical position. They also determined that the sling capacity did not meet the requirements specified in the lift plan. No one was working in line with the swing- or fall- radius of the pipe, and there were no injuries to personnel or damage to equipment as a result of the sling failure. (ORPS Report OH-FN-FDF-FEMP-1998-0001)

Figure 6-1 shows the rigging arrangement used for the lift. The riggers lifted the pipe twice during installation. After excavators dug a hole for placement of the pipe, the riggers lifted it and placed it vertically into the hole. However, project personnel realized that more excavation was needed, so the riggers removed the pipe and placed it horizontally on the ground. After additional excavation, riggers started a second lift to the vertical position, and one of the slings failed. The pipe was suspended by the remaining sling, and riggers were able to safely lower it to the ground.

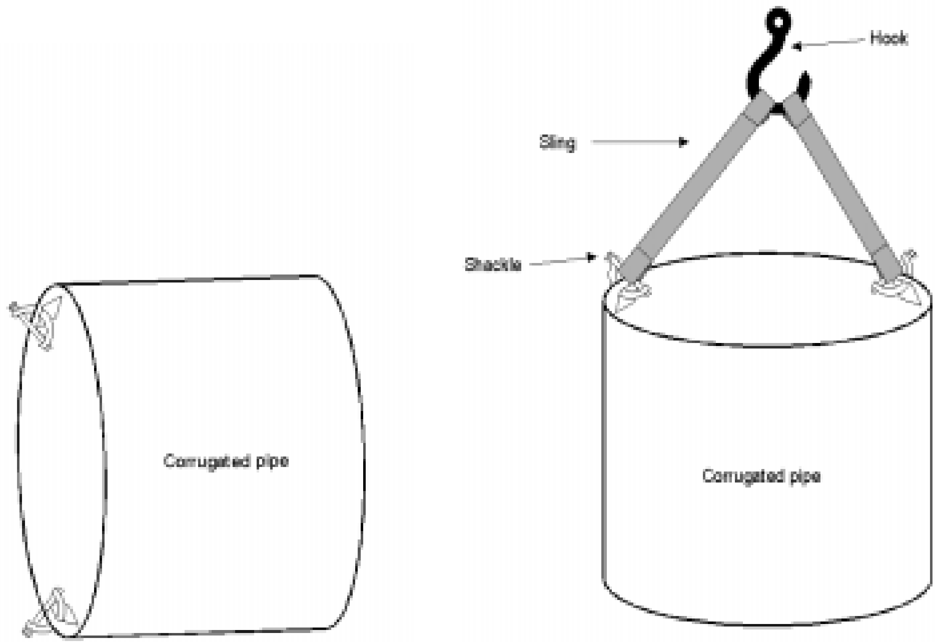

Figure 6-1. Rigging Arrangement (not to scale)

Investigators determined that the riggers inspected the slings before the lift and found them in good condition. After inspecting the failed sling, investigators determined that it probably was cut by the edge of the pipe as it was being positioned. They also determined that the failed sling was rated for 3,200 pounds, but the lift plan specified a 4,800-pound-capacity sling. The actual weight of the pipe was 3,771 pounds. Investigators learned that the subcontractor purchased new nylon slings rated for 6,400-pound-capacity and used them to complete the job of lowering the pipe into the hole.

NFS has reported the following events where loads exceeded lifting-equipment capacities in the Weekly Summary.

- Weekly Summary 97-44 reported that millwrights at the High Flux Isotope Reactor at the Oak Ridge National Laboratory lifted a pressurizer pump motor that exceeded the posted load rating on a monorail hoist. The millwrights did not know the weight of the motor when they performed the lift. Drawings indicated that the motor weighed approximately 3,000 pounds; the monorail and hoist had an assigned capacity of 1 ton. (ORPS Report ORO--ORNL-X10HFIR-1997-0018)

- Weekly Summary 96-48 reported that a rigging crew at Hanford lifted a tank that exceeded the maximum rated capacity of the auxiliary hook on a 40-ton crane. The field superintendent calculated the weight of the tank to be 4,000 pounds; the actual weight was 15,700 pounds. The cable separated from its assembly, and the tank dropped 2 inches to the ground. (ORPS Report RL--BHI-NREACTOR-1996-0017 and Lessons Learned List Server 1996-RL-FDH-0058)

- Weekly Summary 96-31 reported that during post-maintenance testing of a 10-ton crane at Hanford, testers used a concrete block that was calculated to weigh 16,800 pounds, but actually weighed 24,750 pounds. No one was injured, and the equipment was not damaged. The facility manager suspended use of the crane. (ORPS Report RL--WHC-TPLANT-1996-0012)

- Weekly Summary 96-14 reported that a crane operator at Hanford misread a load cell and lifted an overpack attached to a fuel cask to approximately 5,000 pounds instead of the 1,500-pounds required by procedure. (ORPS Report RL--WHC-FFTF-1996-0003)

- Weekly Summary 96-07 reported that a crane operator at Argonne National Laboratory—West used the wrong capacity sling to rig and hoist a transfer cask shield ring. The load was more than double the sling capacity. The rated capacity for the sling was 2,500 pounds, and the shield ring weighed 5,200 pounds. Investigators determined that the crane operator failed to check the load weight and capacity of the rigging before performing the lift. (ORPS Report CH--AA-ANLW-HFEF-1996-0001)

These events illustrate the importance of ensuring that the rigging is not exposed to sharp edges and that the load does not exceed the rated capacity of the hoisting and rigging equipment. Dropped loads can be extremely hazardous. DOE-STD-1090-96 (rev 1), *Hoisting and Rigging*, provides guidance for hoisting and rigging and identifies related codes, standards, and regulations. The following guidance applies to this event.

- Section 3.2.4, “Equipment/Rigging Selection,” recommends determining the type, class, and minimum capacity of lifting equipment (hoist, crane, forklift, etc.) required for the operation based on the identified load, task, and hazards.

- Section 8.5.2, “Size of Load,” requires that personnel know the weight of the load and do not load the hoist beyond the rated capacity, except as provided for in section 8.3, “Testing.”

- Section 8.5.6, “Ordinary Lifts,” states that a designated leader shall ensure that the weight of the load is determined and that proper equipment and accessories are selected.

- Section 11.3.5, “Synthetic-Web Slings,” specifies requirements for nylon slings and includes requirements for protecting slings from sharp-cornered objects and for proof-testing. The standard allows for proof-testing by the manufacturer if the manufacturer provides certification that the sling was proof-tested to 200 percent of rated capacity.

ASME B30.20-1993, *Below-The-Hook Lifting Devices*, chapter 20-1, applies to the classification, construction, inspection, installation, testing, maintenance, and operation of structural and mechanical lifting devices.

KEYWORDS: hoisting and rigging, lift, dropped load

FUNCTIONAL AREAS: Hoisting and Rigging, Industrial Safety

OEAF FOLLOW-UP ACTIVITIES

1. CORRECTION TO WEEKLY SUMARY 98-03, FINAL REPORTS, ARTICLE 1

Article 1 in the final reports section in Weekly Summary 98-03 incorrectly referenced 10 CFR 835, sub-part L. The correct title for this reference is *Occupational Radiation Protection*. In addition, 10 CFR 835, sub-part L, does not apply to activated material as discussed in the article and should not have been used.

KEYWORDS: radiation protection, labeling, radioactive material

FUNCTIONAL AREAS: Radiation Protection, Material Handling/Storage